What is claimed is:

1.   A method for performing 2:1 downscaling on video data, comprising the steps of:

forming at least one input matrix of NxN Discrete Cosine Transform (DCT) coefficients from the video data by combining four N/2xN/2 field-mode DCT blocks;

performing vertical downsampling and de-interlacing to the input matrix to obtain two N/2xN/2 frame-mode DCT blocks;

forming an NxN/2 input matrix from the two frame-mode DCT blocks; and

performing horizontal downsampling to the NxN/2 matrix to obtain one N/2xN/2 frame-mode DCT block.

2.   The method of claim 1, wherein N=16.

3.   The method of claim 1, wherein:

the vertical downsampling also achieves low pass filtering of the NxN input matrix.

4.   The method of claim 1, wherein:

the vertical downsampling uses a sparse downsampling matrix.

5.   The method of claim 4, wherein:

the sparse downsampling matrix=$0.5[I_8 \ I_8]$, where I_8 is an 8x8 identity matrix.

6.   The method of claim 1, wherein:

the horizontal downsampling uses a sparse downsampling matrix composed of odd "O" and even "E" matrices.

7.   The method of claim 6, wherein:

the even matrix has the following form:

E = [e(0) 0   0   0,

        0   e(1) 0   e(2),

        0   0   0   0,

        0   e(3) 0   e(4),

        0   0   e(5) 0,

        0   e(6) 0   e(7),

        0   0   0   0,

        0   e(8) 0   e(9)]

where e(1) through e(9) are non-zero coefficients; and

the odd matrix has the following form:

O = [0   0   0   0,

        o(0) 0   o(1) 0,

        0   o(2) 0   0,

        o(3) 0   o(4) 0,

        0   0   0   0,

        o(5) 0   o(6) 0,

        0   0   0   o(7),

        o(8) 0   o(9) 0]

where o(1) through o(9) are non-zero coefficients.

8.   An apparatus for performing 2:1 downscaling on
video data, comprising:

    means for forming at least one input matrix of NxN
Discrete Cosine Transform (DCT) coefficients from the
video data by combining four N/2xN/2 field-mode DCT
blocks;

    means for performing vertical downsampling and de-
interlacing to the input matrix to obtain two N/2xN/2
frame-mode DCT blocks;

    means for forming an NxN/2 input matrix from the
two frame-mode DCT blocks; and

    means for performing horizontal downsampling to
the NxN/2 matrix to obtain one N/2xN/2 frame-mode DCT
block.

9.   The apparatus of claim 8, wherein N=16.

10.   The apparatus of claim 8, wherein:
    the means for performing vertical downsampling
also achieves low pass filtering of the NxN input
matrix.

11.   The apparatus of claim 8, wherein:
    the means for performing vertical downsampling
uses a sparse downsampling matrix.

12.   The apparatus of claim 11, wherein:
    the sparse downsampling matrix=$0.5[I_8 \ I_8]$, where I_8
is an 8x8 identity matrix.

13.   The apparatus of claim 8, wherein:

the means for performing horizontal downsampling uses a sparse downsampling matrix composed of odd "O" and even "E" matrices.

14.   The apparatus of claim 13, wherein:

the even matrix has the following form:

$$E = [e(0) \quad 0 \quad 0 \quad 0,$$
$$0 \quad e(1) \quad 0 \quad e(2),$$
$$0 \quad 0 \quad 0 \quad 0,$$
$$0 \quad e(3) \quad 0 \quad e(4),$$
$$0 \quad 0 \quad e(5) \quad 0,$$
$$0 \quad e(6) \quad 0 \quad e(7),$$
$$0 \quad 0 \quad 0 \quad 0,$$
$$0 \quad e(8) \quad 0 \quad e(9)]$$

where e(1) through e(9) are non-zero coefficients; and

the odd matrix has the following form:

$$O = [0 \quad 0 \quad 0 \quad 0,$$
$$o(0) \quad 0 \quad o(1) \quad 0,$$
$$0 \quad o(2) \quad 0 \quad 0,$$
$$o(3) \quad 0 \quad o(4) \quad 0,$$
$$0 \quad 0 \quad 0 \quad 0,$$
$$o(5) \quad 0 \quad o(6) \quad 0,$$
$$0 \quad 0 \quad 0 \quad o(7),$$
$$o(8) \quad 0 \quad o(9) \quad 0]$$

where o(1) through o(9) are non-zero coefficients.